

THE BATS OF WESTERN INDIA REVISITED<sup>1</sup>

Part 3

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(With two plates and eight text-figures)

(Continued from Vol. 91(2): 240)

Family RHINOLOPHIDAE

**Rhinolophus rouxii** Temminck, 1835 - Rufous Horseshoe bat

*Rhinolophus rouxii* Temminck, 1835: Monographies de Mammalogie, 2: 30b. Pondicherry and Calcutta, India.

**External characters:** A medium-sized *Rhinolophus*, except for specimens from the Himalayas which average smaller; wings with a gradual decrease in size of metacarpals from the longer fifth to shorter third, in *R. ferrumequinum* the third is distinctly shorter than the fourth; in *rouxii*, the second phalanx of the third finger is usually equal to or less than 1.5 times the length of the first phalanx, in *R. affinis*, it is considerably longer and exceeds 1.5 times. Lancet of horseshoe variable in height, sometimes triangular in shape with straight sides, sometimes with well developed tip and concave margins below; superior connecting process of the sella rounded off above, comparable in morphology to that of *ferrumequinum* and *affinis*. Ears relatively small, especially in comparison to *ferrumequinum*. Pelage soft and silky, not woolly as in the larger *luctus*; considerable variation in pelage colour ranging from orange, to russet brown to buffy brown to grey; an apparent seasonal bias in colour such that the orange and rufous tints predominate from October to April and the paler phases are most common in specimens collected from May to September; no sexual bias.

**Cranial and dental characters:** Condylor canine length of *R. r. rouxii* is comparable in size to that of *R. affinis*; palate with a relatively longer antero-posterior diameter, usually in excess of 1/4 of upper

toothrow; mesopterygoid space broadly rounded off anteriorly, not narrowed as in *R. ferrumequinum*.

Dentition less robust than that of *R. ferrumequinum*; canine not in contact with the second upper premolar (pm<sup>4</sup>); first upper premolar (pm<sup>2</sup>) is well developed and usually situated in the toothrow; second lower premolar (pm<sup>3</sup>) is also usually situated in the toothrow, although it may be extruded in a minority of specimens; the first (pm<sub>2</sub>) and third (pm<sub>4</sub>) premolars are not usually in contact.

*Dental formula:* i 1/2 c 1/1 pm 2/3 m 3/3 = 32.

**Measurements:** Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	55.6	42 - 63	5.4	73
T:	27.1	23 - 33	2.2	76
HF:	10.6	8.0 - 12.8	1.2	73
TIBIA:	21.8	18.5 - 24.3	1.3	56
FA:	47.9	44 - 52	1.8	87
3MET:	36.8	33.0 - 39.4	1.3	80
4MET:	37.6	34.2 - 39.9	1.2	80
5MET:	38.0	35.5 - 40.3	1.2	80
3MET/1PH	14.2	10.7 - 16.1	2.0	67
3MET/2PH	21.1	17.9 - 24.2	1.4	62
WSP:	301.6	287 - 320	14.2	5
E:	19.6	15.5 - 22.0	1.2	71
GTL:	21.9	20.2 - 23.5	0.9	70
CCL:	18.9	17.4 - 21.0	0.9	82
ZB:	10.9	10.1 - 11.7	0.4	86
BB:	9.0	8.2 - 9.5	0.3	88
PC:	2.4	2.1 - 2.8	0.1	90
C-M <sup>3</sup> :	8.4	7.6 - 9.2	0.4	98
C-M <sub>3</sub> :	9.1	8.1 - 10.0	0.5	99
M:	15.0	13.4 - 16.4	0.7	99
M <sup>2</sup> -M <sub>2</sub> :	7.6	7.0 - 8.2	0.3	94

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Fig. 11. *Rhinolophus rouxii* ranges from India and Sri Lanka to southern China and Vietnam.

Records from INDIA include Solan [1], (Das, 1986) in **Himachal Pradesh**; Asgani [nl]; Savantvadi [2], (BMNH coll.); Bassein [3]; Borivli [4]; Vihar Lake [5]; Kanheri Caves [6]; Karnala [7]; Lohogad Fort [8]; Mahableshwar [9]; Bhaja Caves [10]; Khandala [11], (Brosset, 1962a); Poona [12], (Modak & Kamat, 1968) in **Maharashtra**; Poinguinim [13], (Agrawal, 1973); Canacona [14], (Sinha, 1973) in **Goa**; Yellapur [15], (BMNH coll.); Devikop [16], (Wroughton, 1912b); Potoli [17]; Dandeli [18]; Barchi [19]; Hulekal [nl]; Gersoppa [20], (Wroughton, 1913); Sirsi [21], (Brosset, 1962a); Seringapatnam [22], (Ryley, 1913a); Bangalore [23], (Gopalakrishna & Rao, 1977); Talewadi [24], (this paper) in **Karnataka**; Tellicherry [25], (Jerdon, 1874); Silent Valley [26], (Das, 1986) in **Kerala**; Pondicherry [27], (type loc. of *rouxii*); Coonoor [28], (Blanford, 1888-91); Shevaroy Hills [29]; Benhoke [30]; Palni Hills [31], (Sinha, 1973) in **Tamil Nadu**; Cuddapah [32]; Balapalli Range [33], (Sinha, 1973) in **Andhra Pradesh**; Udaygiri [34]; Jharsuguda [35]; Kotagarh [36], (Das & Agrawal, 1973) in **Orissa**; Bastar district [37], (Das, 1986) in **Madhya Pradesh**; Mussoorie [38], (Blanford, 1888-91); Dhakuri [39], (Wroughton, 1914) in **Uttar Pradesh**; Calcutta [40], (type loc. of *rouxii*); Pashok [41]; Darjeeling [42], (BMNH coll.); Nimbong [43], (Sinha, 1973); Ajodhya Hills [44], (Das, 1986) in **West Bengal**; Tashiding [45], (Bhat, 1972) in **Sikkim** and Siki [46], (Lal, 1982) in **Arunachal Pradesh**. Extralimital localities based on BMNH and HZM collections for NEPAL; type localities of *rubidus*, *rammanika* and *cinerascens*, Phillips (1980), Wroughton (1915b) and Neuweiler *et al.* (1987) for SRILANKA and Lal (1981) for upper BURMA.

**Ecology:** *Rhinolophus rouxii* is a forest species which is restricted to areas of relatively high rainfall. Its diurnal roosts tend to be humid and include caves, tunnels, hollow trees, wells, temples and less frequently old houses and barns. Males are excluded from the colonies during the period of parturition and lactation. The diet is comprised of grasshoppers, moths (Brosset 1962a); beetles and termites (Phillips 1924). Feeding begins after sunset; initially insects are mainly caught on the wing, the feeding flight is low, below tree top level, and individuals may often pass through near impenetrable bushes; this is followed by a period of inactivity of about 60-120 minutes; thereafter individuals forage throughout the night, but in "flycatcher style", alighting on a specific perch, such as dead twig and making very short flights to catch passing prey (Neuweiler *et al.* 1987).

**Biology:** There is a sharply defined breeding season. In Khandala, copulation takes place during the last week of December. The early development of the egg is slow and there is delayed implantation of the blastocyst. Gestation lasts 150-160 days and parturition occurs during the last week of May or early June in single sex maternal colonies, (Ramakrishna 1978). Lactation continues until the first week of August (Gopalakrishna and Rao 1977). Parturition occurs in May in Bangalore (Ramakrishna 1978).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Talewadi (25 March)	Not known probably between 60-150 individuals	6	Large cave in forested area
Robbers' Cave Mahableshwar (28 March)	Not known	1	Natural cave with permanent water inside

**Discussion:** During the March 1992 survey, this species was observed at two sites. In both cases, the colony size could not be determined with accuracy. Brosset (1962a) located eleven colonies which ranged in numbers from a single individual to several hundred.

**Status:** This would appear to be a common species in India and requires no special conservation measures.

**Rhinolophus lepidus** Blyth, 1844 — Blyth's Horseshoe bat

*Rhinolophus lepidus* Blyth, 1844: Journal Asiat. Soc. Bengal, 13: 486. ? Calcutta.

**External characters:** This is a relatively small species of *Rhinolophus*. The forearm averages longer than that of *R. pusillus* and greatly exceeds that of *R. subbadius*. The pelage is typically grey-brown dorsally and slightly paler ventrally.

The horseshoe of the noseleaf measures between 6.8-7.3 mm in greatest breadth; the median emargination is narrow, lacking any posterior triangular groove. In contrast to *R. pusillus*, the sella is narrow basally and is not expanded centrally to any conspicuous extent; its upper part is parallel-margined or cuneate to a rounded tip. The connecting process is triangular with a straight anterior margin, blunt point and convex posterior margin. The lancet is triangular, tall and narrow with a blunt point (Hill and Yoshiyuki 1980).

**Cranial and dental characters:** The small skull has a well developed rostrum; rostral width, measured adjacent to the nasal swellings, ranges from 4.5-4.8 mm in *R. lepidus* to 4.1-4.5 mm in *R. pusillus*. In *R. hipposideros*, it is about 3.6 mm. The palate is emarginated anteriorly to a point equal to the paracone of  $m^1$  and posteriorly to the metacone of  $m^2$ . The tympanic bullae are small, covering less than half of the large cochleae; the upper dentition usually exceeds 6.0 mm in length; in *R. pusillus* it is normally less than 6.0 mm. The small upper incisor is bicuspid; the first premolar ( $pm^2$ ) is a functional tooth that lies within the toothrow.

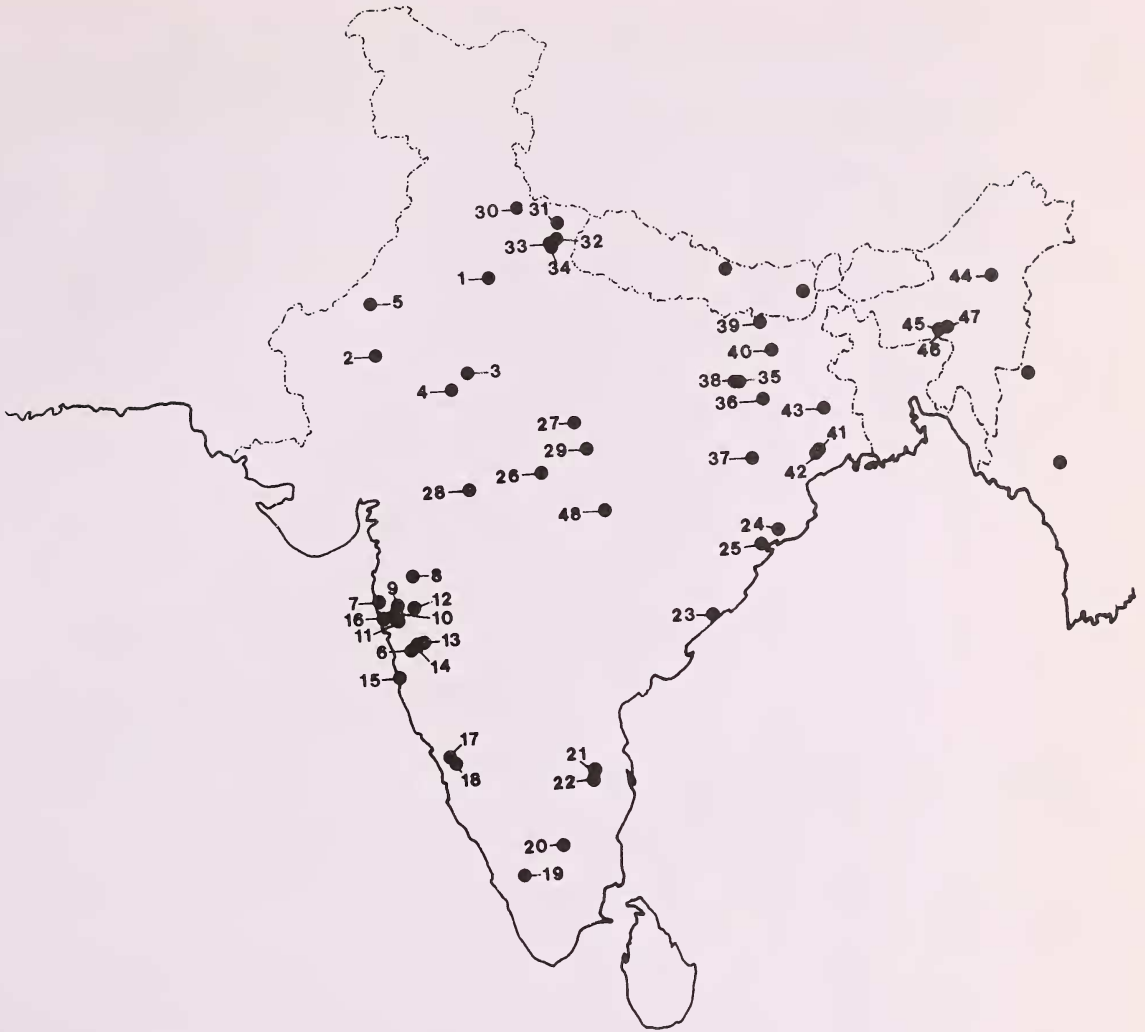


Fig. 12. *Rhinolophus lepidus* ranges from Afghanistan, India, Burma and Thailand to southern China, Malaya and Sumatra.

Records from INDIA include Delhi [1], (Brosset, 1962a) in **Delhi**; Jodhpur [2]; Ranthambhore [3]; Sikar Burz [4]; Bikaner [5], (Prakash, 1961) in **Rajasthan**; Helwak [6], (Wroughton, 1916a); Kanheri [7]; Nasik [8]; Karnala [9]; Khandala [10]; Lonavla [11]; Lohogad [12]; Panchgani [13]; Mahableshwar [14]; Ratnagiri [15], (Brosset, 1962a); Khopoli [16], (Tiwari et al., 1971) in **Maharashtra**; Jog Falls [17], (BMNH coll.); Gersoppa [18], (Wroughton, 1913) in **Karnataka**; Silent Valley [19], (Das, 1986) in **Kerala**; Salem [20], (Das, 1986) in **Tamil Nadu**; Palkonda Hills [21]; Koduru [22], (BMNH coll.); Vishakhapatnam district [23], (Das, 1986) in **Andhra Pradesh**; Khandagiri [24]; Mohana [25], (Das & Agrawal, 1973) in **Orissa**; Sohagpur [26]; Narsingarh [27], (Wroughton, 1913); Mandu [28], (Brosset, 1962a); Jabalpur district [29], (Khajuria, 1979) in **Madhya Pradesh**; Mussoorie [30], (type loc. of *monticola*); Khati [31]; Almora [32]; Ranibag [33]; Philibhit [34], (Wroughton, 1914) in **Uttar Pradesh**; Singar [35]; Nimiaghat [36]; Luia [37], (Wroughton, 1915c); Gaya [38], (Siddiqi, 1961); Madhuban [39]; Munger [40]; Manharpur [nl], (Sinha, 1986) in **Bihar**; Midnapore [41], (Siddiqi, 1961); Salbani [42], (Sinha, 1980); Gurup [43], (Lal & Biswas, 1985) in **West Bengal**; Sibsagar [44], (Kurup, 1968) in **Assam**; Syndai [45]; Konshnong [46]; Shangpung [47], (Hinton & Lindsay, 1927) in **Meghalaya**. Extralimital localities based on Mitchell (1980) for **NEPAL**; BMNH coll., Wroughton (1915a) and Wroughton (1916a) for upper **BURMA**.



**Measurements:** Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range		s	n
HB:	44.9	39	- 54	4.1	22
T:	22.1	18	- 28	3.2	22
HF:	7.9	5.5	- 9.8	1.2	23
TIBIA:	16.5	14.9	- 17.4	0.6	19
FA:	40.0	38.0	- 41.8	1.0	24
3MET:	31.0	29.0	- 33.1	1.0	19
4MET:	31.7	30.0	- 33.6	0.9	19
5MET:	31.4	29.7	- 33.3	0.8	19
E:	16.5	15.0	- 18.2	0.9	22
GTL:	17.8	17.0	- 18.4	0.5	6
CCL:	15.0	14.5	- 15.5	0.3	16
ZB:	8.3	8.0	- 8.8	0.2	19
BB:	7.3	6.7	- 7.8	0.3	19
PC:	2.2	1.8	- 2.6	0.2	20
C-M <sup>2</sup> :	6.3	6.0	- 6.8	0.2	20
C-M <sub>3</sub> :	6.7	6.4	- 7.4	0.2	20
M:	11.4	10.7	- 12.1	0.4	20
M <sup>2</sup> -M <sup>2</sup> :	5.9	5.6	- 6.7	0.3	20

**Ecology:** *Rhinolophus lepidus* favours wooded or forested country (Brosset 1962a), although Prakash (1961) found it in small numbers at Bikaner in a desert biome. It is found at a variety of altitudes ranging from 246-2338 metres (800-7600 feet) (Wroughton 1914). Diurnal roosts include dungeons, caves, tunnels, subterranean silos (Brosset 1962a), old houses (Sinha 1986) and ruined temples, (Lal and Biswas 1985). It sometimes lives alone or in scattered groups or sometimes in very compact clusters where a dozen to several hundred individuals are closely pressed together. The two sexes are not segregated. There appears to be a small, well marked hunting territory, which is often close to the diurnal roost. It hunts alone with a slow, low and fanciful flight.

It explores the foliage of trees, coming and going through the branches, with frequent stops to pick an insect off a leaf (Brosset 1962a). It feeds on small insects such as mosquitoes, small moths and

Coleoptera (Brosset 1962a); Dipteran flies and Hymenopteran insects (Sinha 1986).

**Biology:** In Maharashtra, females give birth to a single infant at the beginning of May (Brosset 1962a).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Hindola Palace, Mandu (11 March)	Three colonies: each of 40-50 individuals	4	Dungeons near palace
Lohani Caves, Mandu (13 March)	50- 60 individuals	2	Man-made caves, with water supply inside

**Discussion:** During the March 1992 survey, this species was seen at two different localities at Mandu. The colony sizes appeared similar to those observed by Brosset (1962a) in this ancient city. Brosset also collected specimens at Mahableshtar. This species was not mist netted at this latter locality during the recent survey, but may have been present in small numbers.

**Status:** This species appears to have a relatively stable population. However, many of its diurnal roosts are potentially susceptible to disturbance by man, not least those in sites of archaeological interest. The fitness of populations in roosts such as Mandu and Tuglakabad Fort, New Delhi deserve careful monitoring.

**Hipposideros fulvus** Gray, 1838 — Fulvous Leaf-nosed bat

*Hipposideros fulvus* Gray, 1838: 492. Dharwar, India.

**External characters:** A relatively small species of *Hipposideros* with very large ears. Forearm length exceeds that of *H. ater* but is significantly shorter than that of *H. speoris*. Ears with tips broadly rounded off, posterior margins

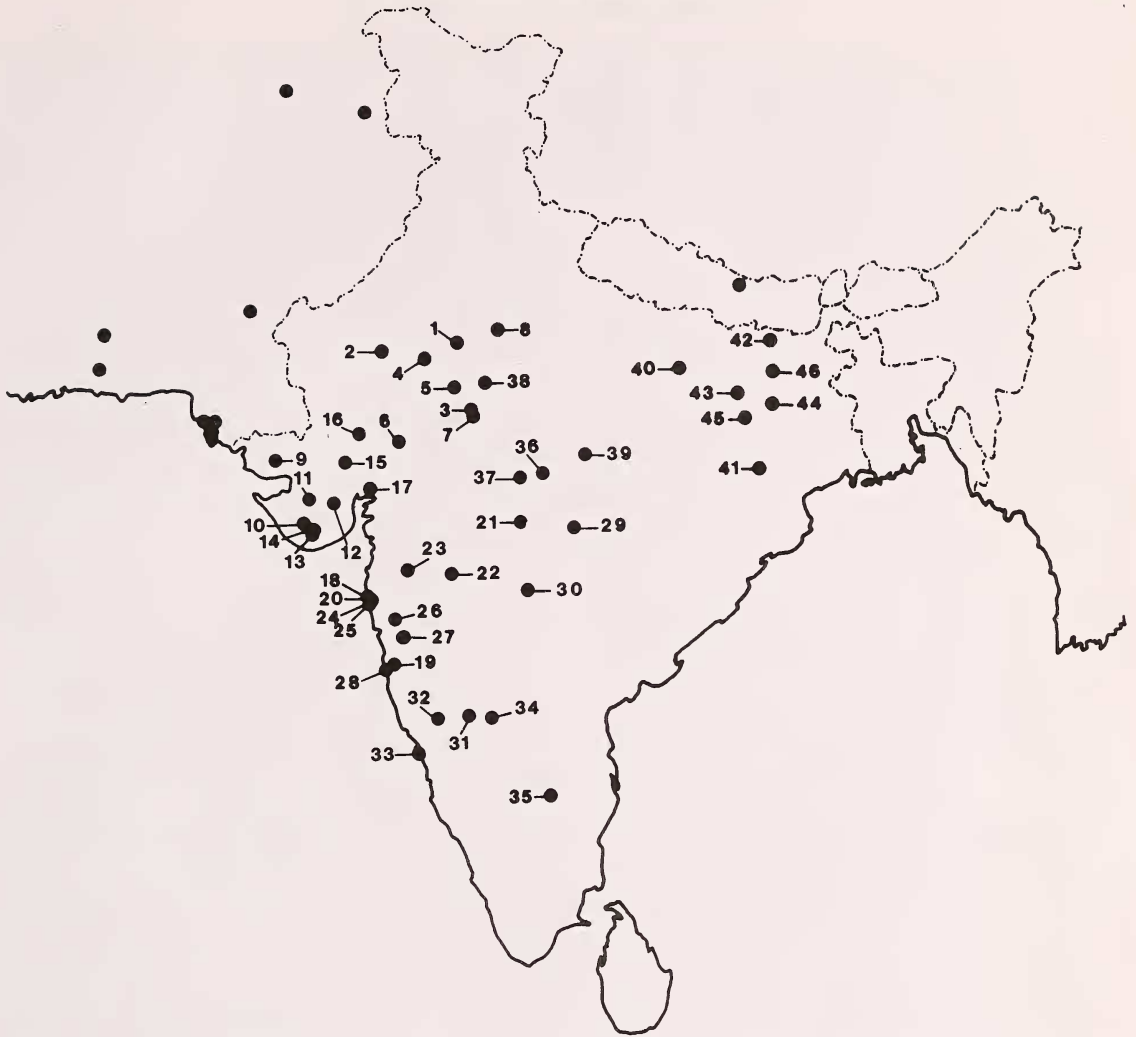


Fig. 13. *Hipposideros fulvus* ranges from Afghanistan to India, Bangladesh and Sri Lanka.

Records from INDIA include Jaipur [1], (BMNH coll.); Jodhpur [2]; Jhalara-Patan [3]; Ajmer [4], (Sinha, 1980); Bundi [5]; Dungarpur [6]; Jhalawar [7], (Advani, 1982); Bharatpur [8], (Bhupathy, 1987) in **Rajasthan**; Bhuj [9], (Wroughton, 1912a); Junagadh [10]; Rajkot [11]; Keshod [12]; Talala [13]; Sasan [14]; Sadla [15], (Ryley, 1913b); Palanpur [16], (Ryley, 1914a); Bochasan [17], (Brosset, 1962a) in **Gujarat**; Bandra [18], (BMNH coll.); Shirgaum [19], (Wroughton, 1916a); Elephanta [20], (Ali, 1953); Chikalda [21]; Aurangabad [22]; Nasik [23]; Bombay [24]; Vihar Lake [25]; Lonavla [26]; Mahabaleshwar [27]; Ratnagiri [28], (Brosset, 1962a); Nagpur [29], (Sabnis, 1973); Nanded [30]; Marathwada [n1], (Madhavan *et al.*, 1978) in **Maharashtra**; Gadag [31]; Dharwar [32], (Wroughton, 1912 b); Honawar [33]; Vijyanagar [34], (Wroughton, 1913); Coromandal [35], (Ryley, 1913a); [specimen from Haleri listed by Ryley (1913b) considered to be type of *pomona*, (Hill *et al.*, 1986)] in **Karnataka**; Sohagpur [36], (BMNH coll.); Hoshangabad [37], (Wroughton, 1913); Shepore [38], (Lindsay, 1927); Jabalpur District [39], (Khajuria, 1979) in **Madhya Pradesh**; Varanasi [40], (Khajuria, 1979) in **Uttar Pradesh**; Chaibassa [41], (BMNH coll.); districts of Darbhanga [42]; Gaya [43]; Giridih [44]; Hazaribag [45] and Munger [46], (Sinha, 1986) in **Bihar**. Extralimital localities based on Siddiqi (1961), Roberts (1977) and Wroughton (1916c) for PAKISTAN and Scully (1887) for NEPAL. There is no confirmation that this species has been found in SRI LANKA; it would appear that past records, (Ryley, 1914b; Wroughton, 1915b), are in fact referable to *H. ater*.

Hill *et al.* (1986) suggest that specimens from Sikkim, north-east India and Burma (and therefore by inference Bangladesh) referred to *H. fulvus* may actually prove to be *H. pomona*; therefore the following records have not been included on the map: Pashok; Narbong, (Wroughton, 1916b) in West Bengal; Rongli, (Wroughton, 1916b) in Sikkim; Nazira; Sibsagar; Cachar, (Kurup, 1968) in Assam; Cherrapunji, (Kurup, 1968) in Meghalaya; Kamorta Island, (Saha, 1980) in Nicobar Islands.

without a concavity near the tip. Noseleaf without supplementary leaflets; anterior leaf with a greatest width of about 5.0 mm; internarial septum uninflated; intermediate leaf simple; posterior leaf subdivided into four cells by three vertical septa. Pelage variable in colour ranging from dull yellow to pale grey to golden-orange. Adult weight ranges from 8 to 9 grams (Gopalakrishna 1969).

**Cranial characters:** Skull intermediate in size between *H. speoris* and the smaller *H. ater*. Rostrum relatively narrower than that of *H. speoris*, with the nasal inflations less developed and without a shallow frontal depression; zygomata with well defined post-orbital projections; anterior border of mesopterygoid space usually V-shaped. Skull differs from that of *H. pomona* in having the posterior part of the vomer narrow and rather more slender, a narrower sphenoidal bridge and a narrower sphenoidal depression, (Hill *et al.* 1986). Anterior upper premolar (pm<sup>2</sup>) minute, extruded from the toothrow, c<sup>1</sup> and second upper premolar (pm<sup>4</sup>) in contact or nearly so. In contrast to *H. pomona*, anterior lower premolar (pm<sub>2</sub>) much reduced, its length one quarter to one third the length of the second premolar (pm<sub>4</sub>), its height one quarter to one half the height of that tooth. In *pomona* pm<sub>2</sub> is less reduced, its length one half or more the length of pm<sup>4</sup> and its height two thirds that of the second tooth (Hill *et al.* 1986).

*Dental formula:* i 1/2 c 1/1 pm 2/2 m 3/3 = 30.

**Measurements:** Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	46.7	40 - 52	3.1	33
T:	29.2	24 - 35	3.2	32
HF:	7.6	5 - 11	1.4	32
FA:	40.4	37.9 - 44.0	1.8	34
E:	21.8	19.0 - 24.0	1.0	32
GTL:	18.0	17.2 - 18.6	0.3	25
CCL:	15.6	15.0 - 16.4	0.3	34
ZB:	9.2	8.6 - 9.6	0.2	38
BB:	8.4	7.5 - 9.4	0.5	37
PC:	2.5	2.2 - 2.8	0.1	41
C-M <sup>3</sup> :	6.3	6.0 - 6.9	0.2	45

C-M <sub>3</sub> :	6.8	6.4 - 7.5	0.2	47
M:	11.5	10.9 - 12.2	0.3	42

**Ecology:** *Hipposideros fulvus* is found in a variety of natural biomes ranging from dry plains to forests at the highest levels of the Ghats (Brosset 1962a). Its diurnal roosts include porcupine earths (Ryley 1913b), cellars, old houses, dilapidated buildings (Madhavan *et al.* 1978), caves, tunnels (Brosset 1962a) and open wells (Roberts 1977). It favours cool damp places and relies on the proximity of water and shade. Colony size ranges from a few individuals to over 200; when roosting it remains isolated from its neighbour.

The hunting territory is close-by and hunting groups are comprised of four to five individuals. The flight is slow and fluttering and it hunts very close to the ground. The roost is often revisited during the night. It appears to favour cockroaches and beetles (Madhavan *et al.* 1978).

**Biology:** In Maharashtra, copulation, ovulation, fertilisation and pregnancy all occur in mid-November. The gestation period lasts 150-160 days and parturition takes place in a two week period during the last week of April and first week of May.

The single infant is carried by the mother continually for 20-22 days or until it weighs about 4.5 grams. Lactation occurs until 29 July; there is communal suckling within the colony.

Sexual maturity for both sexes is attained at 18-19 months.

Adult females are more common than males (Madhavan *et al.* 1978).

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Elephanta (8 March)	18 in three caves	1	Man-made caves

**Discussion:** Brosset (1962a) located this species at nine localities; colony size varied from 8 to 250 individuals. During the recent expedition it was only seen at Elephanta, where the colony



size was considerably reduced from that reported by Brosset (1962a).

**Status:** This species has wide geographical range but appears to have a relatively low population density. It is probable that tourist pressure at some of the more popular archaeological sites has led to a reduction in colony size.

**Hipposideros speoris** (Schneider, 1800) — Schneider's Leaf-nosed bat

*Vespertilio speoris* Schneider, 1800: pl. 59b. Tranquebar, India (Tate 1941: 377).

**External characters:** A medium-small species of *Hipposideros*, with the forearm significantly longer than that of *H. fulvus* but the ears markedly smaller and with pointed tips. Noseleaf with three supplementary leaflets; posterior leaf divided into four cells by three vertical septa, its upper edge slightly thickened and without processes; frontal sac present in males; in females represented by a tuft of hairs. Hind feet large in comparison to those of *H. fulvus*. Pelage colour variable; some individuals are grey, palest on the ventral surface and between the shoulders on the upper back, darker on the flanks and posteriorly; others are yellowish-brown or bright orange-brown. Body weight of males and non-pregnant females is 9-10 grams (Gopalakrishna and Bhatia 1982)

**Cranial and dental characters:** Skull short and robust with the sagittal crest well defined anteriorly and with low supraorbital ridges. Unlike *H. fulvus*, there is a shallow frontal depression. Nasal inflations well developed, separated by a shallow groove; mesopterygoid space is U-shaped anteriorly. Upper incisor simple and spatulate; upper canine with weak anterior and low posterior cusps; anterior upper premolar (pm<sup>2</sup>) compressed and extruded from tooth row; second upper premolar (pm<sup>4</sup>) with well defined anterior cusp; anterior lower premolar (pm<sub>2</sub>) relatively larger than that of *H. fulvus*.

**Measurements:** Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range	s	n
HB:	54.7	46 - 62	3.7	42

T:	25.2	20 - 29	2.3	42
HF:	8.2	7 - 11	0.7	42
FA:	50.8	46 - 54	1.6	50
E:	16.9	13 - 19	1.3	43
GTL:	19.4	18.3 - 20.5	0.5	44
CCL:	16.6	15.9 - 17.5	0.4	52
ZB:	10.9	10.2 - 11.5	0.4	53
BB:	8.6	8.1 - 9.0	0.3	53
PC:	2.9	2.5 - 3.2	0.2	63
C-M <sup>3</sup> :	7.2	6.6 - 7.5	0.2	67
C-M <sub>3</sub> :	7.7	7.2 - 8.5	0.3	67
M:	13.1	12.3 - 13.9	0.3	66

**Ecology:** *Hipposideros speoris* is found in a variety of biotopes ranging from dry, flat country to forested hills; it has been collected at altitudes ranging upto 1385 metres (4500 feet) in Sri Lanka (Phillips 1980). Its diurnal roosts include crevices in hills (Wroughton 1913); caves, caverns; disused buildings (Phillips 1980); tunnels and temples (Brosset 1962a). Colony size ranges from a few individuals to several hundred or even a thousand (Brosset 1962a, Usman 1988). According to Brosset (1962a), at Badami in Karnataka, it leaves the diurnal roost about 10 minutes after sunset and tends to feed close to the roost. It hunts in groups of 10-15 individuals, flying close to the ground, almost touching rocks and bushes, with a slow but very skilful flight and with continual changes of direction. It feeds on mosquitoes, flies (Brosset 1962a); beetles and other low flying insects, especially termites (Phillips 1980).

**Biology:** At Chandrapur in Maharashtra, copulation, followed by ovulation and fertilization, takes place in different individuals of the colony on different dates from the last week of December to the second week of March. Gestation lasts for 135-140 days and parturition in the colony takes place from the first week of May to the last week of July. The majority of deliveries occur between 17 May and 13 June.

Females in lactation were collected until 14 September. The single infant is carried by the mother until it weighs about 6 grams. Females attain sexual maturity at 7.5 to 8 months whilst males do





Fig. 14. *Hipposideros speoris* is confined to the Indian subcontinent.

Records from INDIA include Baroda [1]; Rajmahal [2], (Sinha, 1981) in Gujarat; Asgani [nl], (BMNH coll.); Elephanta [3]; Borivli [4]; Kanheri [5]; Poona [6]; Alibag [7]; Pakhal [8], (Shivkumara Swamy *et al.*, 1984); Chanda [8], (Blanford, 1888-91); Nanded district [9], (Gopalakrishna & Bhatia, 1982); Ellora [10], (this paper) in Maharashtra; Mysore [11]; Kolar [50], (BMNH coll.); Gadag [12], (Wroughton, 1912b); Gersoppa [13]; Honawar [14]; Vijayanagar [15], (Wroughton, 1913); Seringapatam [16]; Sivasamudram [17], (Ryley, 1913a); Wotekolli [18], (Ryley, 1913b); Hampi [19]; Pattadkal [20]; Badami [21], (Brosset, 1962a); Belgaum [22], (Sinha, 1976); Bangalore [23], (Ramakrishna *et al.*, 1981) in Karnataka; Trivandrum [24], (Sinha, 1976) in Kerala; Kurumbapatti [nl]; Tirthamalai [nl], (BMNH coll); Salem [25]; Madras [26], (Jerdon, 1874); Trichinopoly [27]; Travancore [28], (Blanford, 1888-91); Nagercoil [29], (Sinha, 1976); Keela Kuyil Kudi [30]; Kanavai Katha Bootham [nl]; Pannian Malai [51], (Usman, 1988); Madurai [31], (Marimuthu & Selvanayagam, 1981) in Tamil Nadu; Koduru [32]; Thummalah [33], (BMNH coll.); Nellore [34], (Jerdon, 1874); Cuddapah [35]; Palkonda Hills [36], (Sinha, 1976) in Andhra Pradesh; Mahendragiri [37], (BMNH coll.) in Orissa; Dehra Dun [38], (Jerdon, 1874) in Uttar Pradesh. Extralimital localities based on BMNH coll., Wroughton (1915b), Phillips (1980) and Ryley (1914b).

not attain maturity until at least 16-17 months (Gopalakrishna and Bhatia 1982). Ramakrishna *et al.* (1981) noted that the breeding season commences in mid-November in Bangalore; in Tamil Nadu, most females gave birth during September and October (Radhamani *et al.* 1990).

## MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Ellora (4 March)	40-50 individuals in cave 16	2	Artificial cave

**Discussion:** Brosset (1962a) located this bat at nine localities. It was extremely common in some sites, for example at Alibag where colony size was estimated at 1000 in a natural cave on a hill. During this recent study, it was only found at Ellora. It was not seen at Elephanta, although Brosset (1962a) had previously located a colony of some 350 specimens in an artificial cave.

**Status:** This is a widespread and plentiful species. Although only one colony was located on this recent survey, it is apparently a common species throughout much of its range.

***Hipposideros lankadiva*** Kelaart, 1850 — Kelaart's Leaf-nosed bat

*Hipposideros lankadiva* Kelaart, 1850: 216. Kandy, Ceylon.

**External characters:** A large *Hipposideros* with a characteristic pelage colour ranging from pale cream, to fulvous brown, orange and even a bright red (Brosset 1962a); tends to be darker on the forehead, shoulders and on the rump; paler on the belly. Noseleaf with four supplementary leaflets bordering the horseshoe, the fourth much reduced, sometimes absent. The maximum weight of males is 76 grams and of non-pregnant females is 55 grams (Sapkal and Bhandarkar 1984).

**Cranial and dental characters:** Skull robust with the frontal region of the rostrum inflated and convex, in *H. armiger* it is flattened; unlike *H.*

*diadema*, there is no posterior depression. Breadth of the frontals (8.1-8.5 mm) is significantly narrower than that of *H. armiger* (9.6 mm). In lateral profile, there is a sharp angle between the plane of the nasal orifice and the dorsal surface of the nasal inflations; in *H. armiger* this sharp angulation is not present. Sagittal crest less well developed than that of *H. armiger* and braincase shallower in dorsal-ventral diameter; mesopterygoid space V-shaped anteriorly, in *H. armiger* it is rounded; cochlea of each tympanic bulla less inflated than that of *H. armiger*. Upper incisor bicuspid; anterior upper premolar (pm<sup>2</sup>) smooth crowned and minute, situated external to the cingulum of c<sup>1</sup>; crown area of outer lower incisor greatly exceeds that of the inner.

**Measurements:** Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range		s	n
HB:	92.2	89	- 98	3.6	5
T:	46.0	39	- 58	7.5	6
HF:	15.3	12.7	- 20	2.6	6
FA:	89	84	- 99	5.2	1
WSP:	468	468	- 468	-	1
E:	23.6	19.5	- 30	37	6
GTL:	32.9	30.2	- 36.0	2.5	7
CCL:	29.4	27.1	- 31.0	1.5	9
ZB:	19.2	17.5	- 20.6	1.2	12
BB:	12.1	11.2	- 13.2	0.8	10
PC:	3.9	3.5	- 4.2	0.3	10
C-M <sup>3</sup> :	13.8	12.5	- 14.5	0.7	14
C-M <sub>3</sub> :	15.2	13.7	- 16.5	1.0	12
M:	24.4	22.0	- 26.2	1.6	13

**Ecology:** *Hipposideros lankadiva* is only known from a few colonies in the Indian subcontinent. Colony size ranges from 50 to several thousand individuals. Roosts include caves, old tunnels (Phillips 1980) and old temples (Sapkal and Bhandarkar 1984). It is easily disturbed, (Sapkal and Bhandarkar 1984) and a colony of the closely related *H. schistaceus* at Vijayanagar was completely deserted after gun-shots were fired within it (Wroughton 1913). Both sexes are usually found



Fig. 15. *Hipposideros lankadiva* is confined to the Indian subcontinent.

Records from INDIA include Bhimbhark [1], (Wason, 1978) in **Rajasthan**; Chandrapur [2], (Sapkal & Bhandarkar, 1984) in **Maharashtra**; Vijayanagar, (referred to *schistaceus* Wroughton, 1913); Kolar [3], (Ryley, 1913a); Gersoppa [4], (Brosset, 1962a) in **Karnataka**; Balharshah [nl], (Gopalakrishna, 1986); Mundra [5]; Hoshangabad [6], (Wroughton, 1913); Mandu [7], (Brosset, 1962a) in **Madhya Pradesh**; Siju Cave [8], (Kurup, 1968) in **Meghalaya**. Extralimital localities based on BMNH coll. and Phillips (1980) for SRI LANKA.



10. *Rhinolophus rouxii*; 11. *Rhinolophus lepidus*; 12. *Hipposideros fulvus*; 13. *Hipposideros speoris*.





14. *Hipposideros lankaiva*; 15. *Otomops wroughtoni*; 16. *Pipistrellus ceylonicus*; 17. *Miniopterus schreibersii*.

in the same colony throughout the year.

When at rest, its wings are not folded round the body but extended as in *Taphozous* and *hinopoma* (Wroughton 1913).

It is frequently a high flyer and may be seen in the early evening, 'hawking' high up in the air, in the company of bats such as *Pipistrellus*, (Wroughton 1913). Its heavy dentition permits it to eat large, hard insects, particularly Coleoptera; quantities of fat are stored at the base of the tail and reabsorbed during winter (Brosset 1962).

**Biology:** It breeds once a year. At Chandrapur, copulation takes place between 22 August and 5 September. The gestation period is about 260 days; it is prolonged due to a retarded development of the embryo after implantation. Deliveries take place between 10-31 May and females were found carrying their single young until 26 June, when the juveniles weighed 22 grams. Sexual maturity is not attained in the year of birth (Sapkal and Bhandarkar 1984).

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Mandu (14 March)	Not located	4	Collected in mist net, situated at head of valley, adjacent to Hotel Nataraj

**Discussion:** This species would appear to be restricted to a limited number of large colonies. Brosset (1962a) observed an enormous colony of 5000-7000 in the subterranean retreats of the Champa Baoli (palace) at Mandu. This has subsequently been superseded by an equally large colony of *Rousettus leschenaultii* and *Taphozous melanopogon*. However, that individuals were caught in a near-by mist net suggests that the colony has moved but is still present within the general area.

**Status:** *Hipposideros lankadiva* is an uncommon species endemic to the subcontinent. It is recorded from just eight localities within India.

It is apparently easily disturbed by man. Its roosts deserve special protection.

**Otomops wroughtoni** (Thomas, 1913) — Wroughton's Free-tailed bat

*Nyctinomus wroughtoni* Thomas, 1913: 87. Barapede Cave, near Talewadi, Kanara, India.

**External characters:** Pelage a rich glossy dark chocolate brown above, especially on crown of head and rump; thin white border on each flank, extending from axilla to groin, and on antibrachial membranes; shoulders and nape of neck with characteristic, strongly contrasting pale greyish white mantle, upper back with admixture of paler hairs; ventral surface, dull brown but with a contrasting grey collar, variably extending onto chin and upper chest; dark hairs present on underside of wing to a line extending from elbow to mid-thigh. Ears very large, connected medially, inner margin convex, dotted with a number of small horny points; tip broadly rounded; no antitragus, but with well developed extra lobe on inner side of conch; tragus minute, triangular. Small, shallow gular sac present in both sexes.

**Cranial and dental characters:** Skull relatively long, smooth and well rounded; a marked concavity present on the upper braincase at the fronto-parietal suture; premaxillaries not always co-ossified; anterior palatal foramen small, flask-shaped, widest posteriorly; posterior edge of palate level with  $m^3$ ; basisphenoid pits deep and sharply defined, with overhanging edges; septum well developed; tympanic bullae very large and elongated, their antero-internal border nearly, or in contact with, pterygoids. Single upper incisor simple, well developed, about half the height of the canine, shaft narrowing both above and below the cingulum; canine slender but well developed, cingulum distinct, but without secondary cusps; first upper premolar ( $pm_2$ ) small, located in tooth row, sometimes in contact with second upper premolar ( $pm_4$ ), which is well developed and with a large antero-internal cusp; upper molars normal.  $m^3$  not greatly reduced; lower incisors very small, bifid, crowns in contact with each other and with canine; lower premolars normal in form and size,



Fig. 16. *Otomops wroughtoni* is only known from the type locality of Barapede Cave, Talewadi near Belgaum [1] in Karnataka, INDIA.



the first ( $pm_2$ ) not as high as second ( $pm_4$ ) but with the cross section nearly as great; lower molars with the three inner cusps approximately equal in height.

Dental formula:  $i\ 1/2\ c\ 1/1\ pm\ 2/2\ m\ 3/3 = 30$ .

Measurements: Based on specimens of both sexes from India.

	mean	range		s	n
HB:	92.1	87	- 99	3.8	11
T:	45.2	43	- 48	2.3	11
HF:	11.8	10	- 14	1.2	11
FA:	64.5	58	- 67	2.7	11
WSP:	421.3	408	- 433	12.6	3
E:	32.5	31	- 34	0.8	11
GTL:	24.8	24.2	- 25.2	0.4	8
CBL:	22.7	22.1	- 23.2	0.4	8
ZB:	13.1	12.6	- 13.3	0.2	7
BB:	11.1	10.9	- 11.3	0.1	8
PC:	5.3	5.1	- 5.6	0.2	10
C-M <sub>2</sub> :	9.0	8.8	- 9.2	0.1	11
C-M <sub>3</sub> :	9.5	9.2	- 9.8	0.2	11
M:	16.4	15.9	- 16.9	0.3	11

**Ecology:** *Otomops wroughtoni* is apparently confined to one diurnal roost, a large natural cave, situated on a remote plateau rising above a forested valley at an altitude of about 800 metres (2600 feet). The entrance to the cave is concealed by trees and bushes. The cave is about 40 metres deep, 25 metres broad and 6-7 metres high; there are permanent patches of water and a high degree of humidity. Colony size is difficult to determine as *Otomops* lives in small groups of usually five to seven individuals in narrow cracks and deep hollows in the roof. During the day, they keep silent and motionless; they hang by their feet, head down and with only the extremity of their muzzles protruding; both sexes live together. According to Prater (1914), a single shot fired into one hollow secured some 30

specimens; later, Brosset (1962b) estimated the whole colony to number about 40 individuals. When disturbed they fly within the cave from one hollow to another. They coexist with *Megaderma spasma* and *Rhinolophus rouxii* (Brosset 1962b). Their flight is strong, fast and straight. According to Brosset (1962b), the dentition is relatively weak and unsuitable for crushing big or hard insects.

**Biology:** A female with a single young was found in December; other females each had a single foetus (Prater 1914). The twelve specimens collected in May 1961 and the one female in March 1992 were sexually dormant.

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Talewadi (25 March)	Uncertain, 40 +	3	Natural cave

**Discussion:** To date, this species is only known from one cave situated near the village of Talewadi. This site has only been visited on a limited number of occasions by zoologists who on each occasion reported the presence of *Otomops* within the cave.

**Status:** An endemic bat with an apparently very restricted range. It deserves all possible protection.

**Pipistrellus ceylonicus** (Kelaart, 1852) — Kelaart's Pipistrelle.

*Scotophilus ceylonicus* Kelaart, 1852: 22. Trincomalee, Ceylon.

**External characters:** A relatively large Pipistrelle, with a forearm that usually exceeds 35 mm; dorsal pelage variable in colour, ranging from grey-brown to chestnut, reddish or golden-brown; belly with dark hair bases and pale tips; adult specimens weigh between 7-8 grams and have a wing span of about 250 mm (Madhavan 1971); each ear with a well developed tragus, which measures 4.5-4.8 mm in height and 2.1-2.4 mm in greatest width, basal lobule well defined; baculum with long slender shaft curved upwards, tip bifid and strongly bifurcate, base also





Fig. 17. *Pipistrellus ceylonicus* ranges from Pakistan, India and Sri Lanka to Burma, China, Vietnam and northern Borneo.

Records from INDIA include Mount Abu [1], (Ryley, 1914a) in Rajasthan; Bulsar [45], (BMNH coll.); Bhuj [2]; Charwa [3], (Wroughton, 1912a); Junagadh [4]; Keshod [5]; Talala [6]; Sasan [7]; Rajkot [8], (Ryley, 1913b); Ahmedabad [9]; Anand [10]; Baroda [11], (Brosset, 1962b); Broach [12]; Rajpipla [13], (Sinha, 1981) in Gujarat; Bandra [46]; Thana [47], (BMNH coll.); Helwak [14], (Wroughton, 1916a); Chikalda [15]; Ajanta [16]; Nasik [17]; Junnar [18]; Bombay [19]; Poona [20]; Satara [21], (Brosset, 1962b); Panchgani [22], (Tiwari *et al.*, 1971); Belgaon [n], (Khajuria, 1967); Aurangabad [23]; Nagpur [24], (Sabnis, 1973); Nanded [25], (Madhavan, 1971) in Maharashtra; Gadag [26], (Wroughton, 1912b); Sirsi [27]; Honawar [28]; Vijyanagar [29], (Wroughton, 1913); Bangalore [30]; Seringapatam [31]; Sivasamudram [32], (Ryley, 1913a); Mercara [33]; Haleri [34]; Wotekolli [35]; Srimangala [36], (Ryley, 1913b); Dharwar [37]; Bellary [38], (Brosset, 1962b) in Karnataka; Nilgiri Hills [48], (BMNH coll.) in Tamil Nadu; Mandu [39], (Brosset, 1962b) in Madhya Pradesh; Hasimara [49], (BMNH coll.); Luia [40], (Wroughton, 1915b); Chota Nagpur [41]; Dhanbad [42], (Sinha, 1986) in Bihar; Calcutta [43], (Lal & Biswas, 1984) in West Bengal. Extralimital localities based on BMNH coll., Roberts (1977) and Wroughton (1916c); Phillips (1980); type loc. of *ceylonicus* and BMNH coll. in SRI LANKA and Ryley (1914b) for upper BURMA.

bifid, broader than tip; basal lobes curved downwards.

**Cranial and dental characters:** Skull exceeds that of *P. javanicus babu* and *P. coromandra* in length; cranial profile is slightly convex, raised above the frontal region, with the lambda the highest point; mastoid flanges well developed; rostrum very broad, with conspicuous incurving margins which produce well defined supraorbital ridges; zygomata are delicate; palatal length exceeds width and upper dentition is not convergent; tympanic bullae relatively small and basiocciput relatively broad. Inner upper incisor ( $i^2$ ) bicuspid, the secondary cusp about three-quarters the height of the principal one; outer incisor ( $i^3$ ) large, two-thirds height of  $i^2$ ; canine with posterior secondary cusp; small anterior premolar ( $pm^2$ ), not greatly reduced, internal to the toothrow, crown area equal to  $i^3$ , not visible from without,  $c^1$  and posterior premolar ( $pm^4$ ) almost in contact; upper molars typical of *Pipistrellus*; lower incisors trifid, slightly imbricated; crown area of posterior premolar ( $pm_1$ ) slightly exceeds that of anterior ( $pm_2$ ).

**Measurements:** Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range		s	n
HB:	54.2	48	- 64	2.9	37
T:	38.1	30	- 45	4.0	38
HF:	8.6	6.5	- 11	1.0	23
FA:	37.6	30	- 42	2.4	31
WSP:	251.0	227	- 262	10.2	12
E:	12.2	9.5	- 17	1.4	35
GTL:	14.9	14.2	- 15.8	0.4	58
CCL:	13.6	12.3	- 15.2	0.4	59
ZB:	9.8	8.9	- 11.0	0.4	35
BB:	7.3	6.6	- 7.8	0.3	59
PC:	4.0	3.7	- 4.3	0.1	59
ROSTRAL B:	6.1	5.3	- 7.0	0.3	57
C-M <sup>3</sup> :	5.4	5.0	- 5.7	0.2	59
M <sup>3</sup> -M <sup>3</sup> :	6.6	5.7	- 7.1	0.3	57
C-M <sup>3</sup> :	5.9	5.5	- 6.3	0.2	59
M:	11.1	10.2	- 12.0	0.4	59

**Ecology:** This is an eclectic species which ranges from the tropical thorn forest of Pakistan to the highlands of central Sri Lanka. It is very

common throughout much of its range and is frequently seen in towns and villages. It inhabits old houses and dilapidated buildings where it roosts between wooden rafters and inside cracks in walls and ceilings (Gopalakrishna and Madhavan 1971). Other diurnal biotopes include holes in trees, hollow branches (Phillips 1980), caves, wells, temples and even a roller blind in an hotel (Brosset 1962b). Colony size tends to be small, ranging from a single individual to a maximum of about 200 (Gopalakrishna and Madhavan 1971). It does not hang suspended like the Rhinolophidae but rather clings to the sides with feet and wing claws, while retaining the head-downwards position (Phillips 1980). It is inactive during cold or wet seasons, when individuals become partially torpid (Madhavan 1971).

It appears early in the evening, almost as soon as the sun has set. It does not fly particularly fast or high but continually turns, twists and wheels in flight. As the evening progresses, it often ascends higher and flies rather straighter. It feeds on small beetles and other insects (Phillips 1980).

**Biology:** In Maharashtra, copulation takes place during the first two weeks of June. The inseminated sperm remains alive inside the female genital tract until about the second week of July when ovulation and fertilisation take place, followed immediately by pregnancy (Gopalakrishna *et al.* 1970).

Gestation lasts about 50-55 days and deliveries take place during the first two weeks of September. Normally each female bears two young; in rare cases there is one young or triplets (Gopalakrishna and Madhavan 1971). The young are carried by the mother for 25-30 days and lactation is concluded by the third week of October.

MATERIAL SEEN AND/OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Khirasara, Rajkot (18 March)	Uncertain	4	Ruins of old fort

**Discussion:** Brosset (1962b) studied this species at 15 sites in central and western India. Colony size varied from a single individual to 100-150 at Karla. It was only collected near Rajkot during this recent study. This however reflects the difficulty in locating its diurnal roosts; its feeding pattern also makes for difficulties in catching it in mist nets.

**Status:** Considered to be extremely common throughout its range (Brosset 1962b).

**Miniopterus schreibersii** (Kuhl, 1819) — Schreibers' Long-fingered bat

*Vespertilio schreibersii* Kuhl, 1819: Annalen Wetterau Ges. Naturk., 4(2): 185. Kulmbazer Cave, mountains of Southern Bannat, Hungary.

**External characters:** A medium-sized Vespertilionid bat with a long tail, interfemoral membrane and hind limbs; wing characterised by a highly developed second phalanx of third finger which is approximately three times the length of the first phalanx; membranes uniformly dark; pelage soft and silky, dark throughout, dorsal surface a rich russet brown in some individuals, others a deeper blackish brown; ventral surface, usually slightly paler with greyer tinge; ears small, with broadly rounded tips which scarcely project above pelage of crown; the tragus is half the height of the pinna, slightly curved forwards; the antitragus is low and ill defined. This species is usually found with numerous ecto-parasites (Phillips 1980).

**Cranial and dental characters:** Skull characterised by marked inflation of braincase anteriorly, abruptly elevated above the low, flattened rostrum; rostrum tapered anteriorly, dorsal surface flattened but with a distinct median concavity; mandible slender with posterior parts very small; the coronoid process almost on a level with the condyle. Crown of inner upper incisor oblique, strongly hollowed out postero-laterally and with weak postero-internal secondary cusp; outer incisor flattened, its cingulum forming a minute postero-external cusp; anterior upper premolar (pm<sup>2</sup>) unusually large, situated in toothrow, broadly triangular crown, with postero-medial base

noticeably expanded; large upper premolar (pm<sup>4</sup>) with well defined antero-medial cingular cusp and feeble antero-lateral one; m<sup>1</sup> and m<sup>2</sup> emarginated posteriorly; deep pits between the metacones and paracones and the protocones; m<sup>3</sup> more than half crown area of m<sup>2</sup> with metacone and third commissure well developed; lower incisors trifold, outer tooth distinctly larger; anterior premolar (pm<sub>2</sub>) subequal in crown area to the second (pm<sub>3</sub>); posterior premolar (pm<sub>4</sub>) three-quarters the height of the canine; m<sub>3</sub> with talonid little reduced, more than half width of m<sub>2</sub>.

**Measurements:** Based on specimens of both sexes from throughout the Indian subcontinent.

	mean	range		s	
HB:	56.0	47	- 65	5.3	21
T:	54.5	48	- 60	3.7	21
HF:	10.0	7	- 12	1.3	21
TIBIA:	19.2	17.7	- 20.5	0.9	12
FA:	47.4	45	- 50.5	1.7	21
3MET:	43.5	41.1	- 45.4	1.2	14
4MET:	41.7	38.9	- 43.0	1.2	14
5MET:	38.4	36.5	- 40.1	1.0	14
3MET/1PH:	11.2	10.2	- 12.2	0.5	14
3MET/2PH:	35.8	31.2	- 40.0	2.7	14
WSP:	325	322	- 328	-	2
E:	11.3	10	- 12	0.8	21
GTL:	15.7	15.3	- 16.1	0.2	20
CCL:	14.2	13.5	- 15.3	0.4	21
ZB:	8.8	8.5	- 9.3	0.2	17
BB:	7.9	7.5	- 8.5	0.2	21
PC:	3.9	3.7	- 4.1	0.1	21
C-M <sup>3</sup> :	6.0	5.7	- 6.2	0.1	20
C-M <sub>3</sub> :	6.5	6.2	- 6.8	0.2	21
M:	11.4	11.1	- 11.9	0.2	21

**Ecology:** *Miniopterus schreibersii* appears to favour hilly and forested country, ranging up to about 2150 metres (7000') in the foothills of the

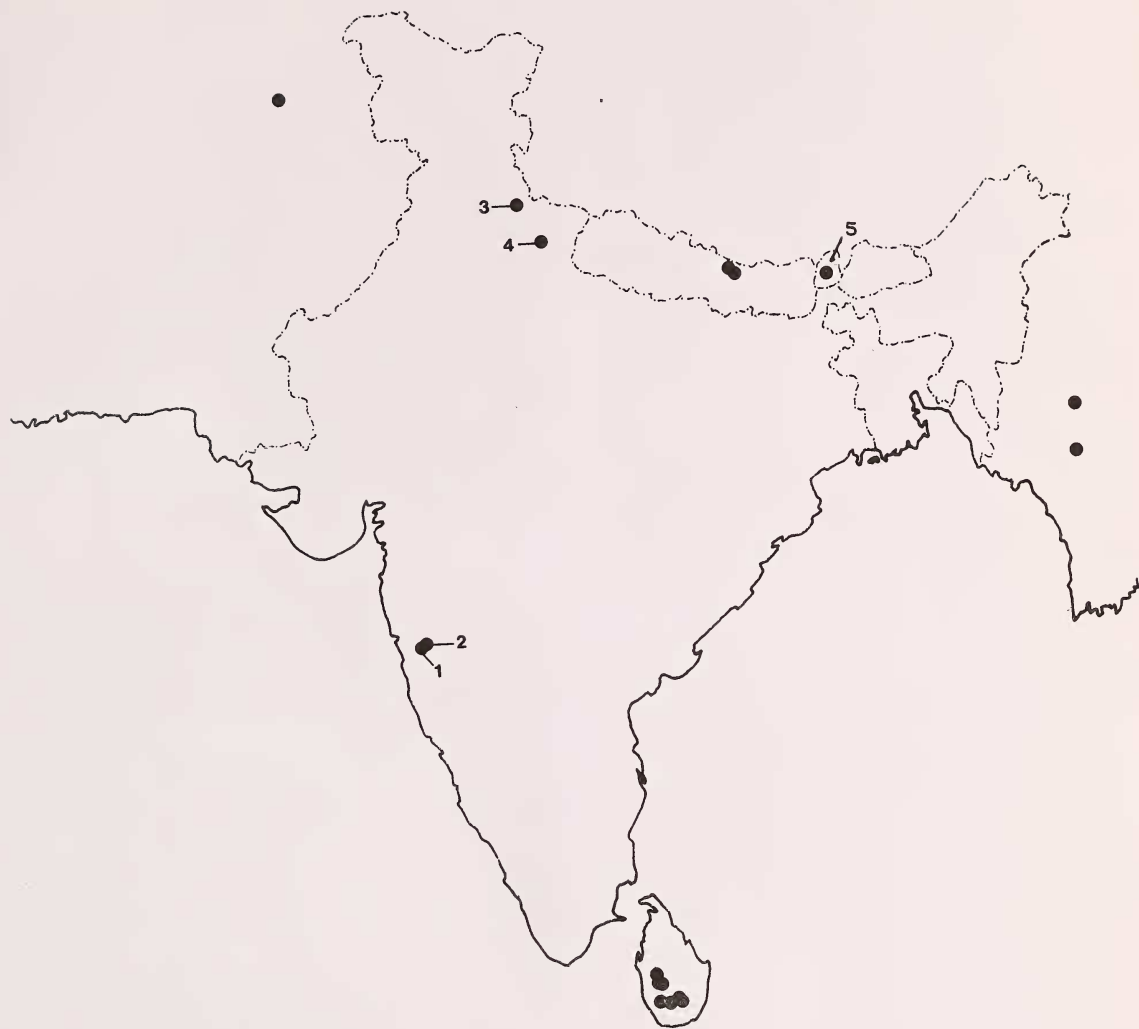


Fig. 18. *Miniopteris schreibersii* ranges from southern Europe and Morocco through the Caucasus and Iran to Japan, the Indian subcontinent and east to Australia; also subsaharan Africa.

Records from INDIA include Mahabaleshwar [1], (Wroughton, 1916a); Panchgani [2], (Brosset, 1962b) in **Maharashtra**; Mussoorie [3], (Scully, 1887); Ramnagar [4], (Wroughton, 1914) in **Uttar Pradesh**; Sonari [5], (BMNH coll.) in **Sikkim**. Extralimital records based on Scully (1887) and HZM coll. for **NEPAL**; BMNH coll., Wroughton (1915a) and Phillips (1924) for upper **BURMA** and Phillips (1980) for **SRI LANKA**.



Himalayas (Blanford 1888-91; HZM collection). The colonies are large but extremely rare; they are situated in caves, caverns and even crevices in rocks (Scully 1887). At Robbers' Cave, near Mahableshwar, Brosset (1962b) estimated there were some 100,000 individuals with a density of about 2000 bats/m<sup>2</sup>; the majority were in vast swarms, neither segregated by sex or age. There appear to be two types of colonies; the 'mother-colony' which is situated in a large natural cave, usually with a subterranean water source inside and 'secondary colony', situated within 70 km of the mother house and located in caves of much smaller size, here groups of individuals stay periodically. The young are confined to the principal diurnal roost. *Miniopterus* leaves its roost soon after sunset to feed; individuals fly away in many different directions and hunt alone. The diet is probably comprised of small insects, including Diptera and Coleoptera (Brosset 1962b).

**Biology:** At Mahableshwar, copulation and conception takes place in the second and third week of February. Gestation lasts 120-125 days; females give birth between 15 and 25 June to a single infant weighing about 3 grams; they carry the new-born young for one or two days after which the infants are gathered into communal groups of 100 or more, which they do not leave until they can fly. Lactating mothers visit the groups to suckle the young and according to Brosset (1962b), suckle the first infant that contacts them, sometimes two feed together. Weaning occurs after two months. There is a single breeding cycle and sexual maturity is attained at about 20 months (Gopalakrishna *et al.* 1985/86).

MATERIAL SEEN AND/ OR COLLECTED IN MARCH 1992

Locality	Size of Colony	No. of specimens taken	Nature of biotope
Robber's cave, Mahableshwar (28 March)	Not known	4	Underground cave

**Discussion:** This species was collected at just one site, Robber's Cave. It is not known whether the colony size has changed since the survey of Brosset (1962b).

**Status:** Although widely distributed, the small number of diurnal roosts within India makes this species vulnerable to disturbance.

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REFERENCES

- ADVANI, R. (1982): Distribution and status of chiroptera species in Rajasthan, India. *Sugertierk. Mitt.* 30 (1): 49-52.
- AGRAWAL, V.C. (1973): On a collection of bats from Goa. *Records zool. Surv. India*, 67: 261-280.
- ALI, S. (1953): How long do small bats (Microchiroptera) live? *J. Bombay nat. Hist. Soc.*, 51: 498-499.
- BHAT, H.R. (1974): Records and observations on bats of Himalayan region of Uttar Pradesh and West Bengal, India. *J. Bombay nat. Hist. Soc.*, 71(1): 51-57.
- BHUPATHY, S. (1987): Occurrence of the bicoloured leaf-nosed bat (*Hipposideros fulvus*) in Rajasthan. *J. Bombay nat. Hist. Soc.* 84(1): 199-200.
- BLANFORD, W.T. (1888-91): The Fauna of British India, including Ceylon and Burma. London. 617 pp.
- BLYTH, E. (1844): Notices of various Mammalia...*Journal Asiatic Soc. Bengal.*, 13: 463-494.
- BROSSET, A. (1962a): The bats of central and western India. Part II. *J. Bombay nat. Hist. Soc.*, 59: 583-624.
- BROSSET, A. (1962b): The bats of central and western India. Part III. *J. Bombay nat. Hist. Soc.*, 59: 707-746.
- DAS, P.K. (1986): Studies on the taxonomy and geographical distribution of the species of bat obtained by the Silent Valley